Advanced International Journal of Multidisciplinary Research
E-ISSN: 2584-0487
editor@aijmr.com
Volume 4, Issue 3, May-June 2026
CrossRef DOI: 10.62127/aijmr.2026.v04i03.1378

Deepest Learning-Based Hybrid Facial Recognition For Improved Drivers License Authentication

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Abstract:
Facial recognition technology is used to provide a safe and dependable driver's license verification system. Variations in lighting conditions, facial alignment, image noise, partial occlusion, and low-quality photographs can all cause problems for conventional facial recognition techniques and reduce their detection accuracy. Strong defense against spoofing and illegal access is also necessary for real-time authentication. Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks are combined in a hybrid strategy to improve recognition accuracy and authentication dependability in order to overcome these issues. Accurate face detection and feature representation are made possible by the CNN model's extraction of important facial traits and spatial data from images. In order to distinguish real users from spoofing attempts, such as printed images or replayed films, the LSTM network examines sequential patterns. The system obtains pertinent data, such as the user's name, license number, date of birth, and address, by securely comparing the verified face with stored licensing records. In real-world settings, the method improves identity verification, lowers unauthorized access, and boosts overall system performance.

Keywords: Facial recognition, Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM), Deep Learning, Driver’s license.

I. INTRODUCTION

The swift progress of the intelligent transportation systems has largely changed the manner in which driver licensing, verification and road safety monitoring is done. The traditional driver license verification and monitoring systems tend to be time consuming and based on manual inspection, which is open to fraud and would probably result in human error. According to recent studies, the combination of virtual reality, computer vision, deep learning, Internet of Things (IoT), and cyber-physical systems is rapidly increasing to enhance the effectiveness, accuracy, and security of driver-related software.

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A number of studies have investigated the simulation method of driver training and training assessment, especially by using VR-capable driving test simulator emulating real-life, with lower risk and low-cost of operation. Simultaneously, both OCR and deep-learning architecture development, including CRNN and YOLO, have increased the accuracy of license plate recognition and text extraction in a wide range of environmental factors. Such systems are used across parking smart, emergency notification and automated toll management systems, showing that vision-based automation of transportation infrastructure has a future.

In addition, smart driver control systems are designed to monitor the behavior of the drivers, their fatigue, and distraction with the help of deep learning and machine learning approaches. Models of cyber-physical systems and wearable sensors also help in real-time safety and behavior monitoring. Verification systems based on facial recognition have appeared as efficient tools to strengthen the American population with unrestricted safety and decrease the number of frauds associated with identity.

However, there are still difficulties with the realization of secure, successful, and real-time facial recognition, liveness detection, license information extraction, and behavioral control within an integrated framework in spite of such improvements. Lighting differences, image quality, spoofing and security issues persist to play on reliability of systems. Hence, an efficient and smart framework, in which superior deep learning methods are integrated, is required to achieve the precision in identifying drivers, the safety in retrieving licenses as well as provide superior authentication capability in real-life scenarios.

II.LITERATURE SURVEY

The driving license testing has also been enhanced with the help of virtual reality (VR). A VR-based driving simulation system was suggested to perform the driving test in a safe and controlled setting, which will enable the realistic testing of the driving skills rather than in the real situation with risks. The experiment proved that full body simulators increased the level of training of drivers and decreased the expenses of operations and the risk of tests [1]. It has made instrouddable use of deep learning based optical character recognition (OCR) techniques to automate the extraction of driving license information. The Convolutional Recurrent Neural Network (CRNN) model was created to identify text in license images and overcome the difficulty of lighting change and distorted inputs. The suggested solution was more accurate than the conventional OCR systems [2]. The artificial intelligence and IoT technologies have been implemented to automate the license issuance process. A driving license system based on AI- and IoT- has been proposed to inspect the performance of vehicles, their drivers, and their compliance with regulations to obtain driving licenses and enhance the level of transparency and human reduction [3]. Vehicle license plate recognition systems OCR have also been used in applications to emergency response. A system that would identify vehicle licenses via the auto identification system was suggested to spoilplate identifications and send out emergency messages in real time through messaging system to enhance the efficiency of the response in emergency cases [4]. Deep learning models like PaddleOCR and YOLO have

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been used in computer vision, as it enables successful license plate recognition and character recognition. An information system of drivers which is in the form of a web-based was created to store information and manage the driver and vehicle information, and to assist in driver monitoring vehicle-centrically [5].Vehicles security has incorporated biometric authentication to improve security. It offered a fingerprint-driven vehicle entrance system and digitally checking driving licenses to ensure their vehicles were used authorized as well as the implementation cost was low [6].

Deep learning coupled with license plate recognition has been useful in smart parking and automated toll collection systems. A YOLOv3 model was applied in order to perform automatic license plate reading to allow efficient parking control and automatic ticket payment [7]. It is in these machine learning methods that Driver Monitoring Systems (DMS) have been suggested to provide an objective view of the driver performance during license tests. These systems interpret the driving behavior in real time, making them objective and more precise in evaluating the driving behavior [8].Facial recognition has been used to do real time check against driving license to help in better control of traffic. A device was created to check the identification of drivers at any moment by means of face recognition, which helped police work and enhanced safety in the road [9].

It has suggested the use of cyber-physical systems and deep learning models to identify tiredness and diversion of the driver. The system was found to be very accurate in real-time tracking, which helped in preventing accidents and smart transportation system [10]. Wearable sensors have also been used to develop non-intrusive driver monitoring methods. An ECG sensor comprised of a textile sensor was presented responsible to classify driver distraction and mental conditions at the expense of driving comfort with the help of convolutional neural networks [11].

III. PROPOSED SYSTEM

The given system is a hybrid facial recognition system to check the security and automated driver license verification with the deep learning approach that is specially aimed to overcome the accuracy, robustness, and security shortcomings of the existing recognition techniques. The system incorporates both Convolutional Neural Networks (CNN) and Long Short-Term Memory (LSTM) networks into one hybrid architecture known as Deep EigenNet, which has shown good trade off with respect to computational efficiency and increased recognition ability. CNN is utilized in the detection of faces and the identification of their faces with accuracy so, the facial area can be accurately localized and the system is able to differentiate between authentic and spoofing users like printed images, video replays or digital impersonation attacks. To further enhance recognition performance in a real-world scenario, it is used with Eigenface-based feature representation in order to learn temporal correlation and face sequential variations thus eliminating the susceptibility of traditional Eigenface based methodology to pose changes, facial expressions and partial blurring. Before extracting features, image preprocessing tools like the histogram equalization and normalization will be used on the image to optimize the quality of the image and minimize the effect of unbalanced illumination and noise. The Adam optimizer optimizes feature learning and classification by administrative of the accelerated convergence and cut-down training time as well as the elevated recognition accuracy. Firebase It is employed in ensuring secure data management

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to store and retrieve data on drivers license information, personal and identification details, to allow smooth and real-time verification. With the incorporation of deep learning, biometric authentication, and cloud-based data storage, the proposed system can greatly improve the recognition accuracy, prevent fake and duplicate driver license and reduce fraud concerning activities, can support rapid and contactless identity verification, properly works under the variability of lighting conditions, pose, and age, reduce the manual verification and human error, effectively resist spoofing and impersonations, and can be scaled to data in a large-scale context to support government and intelligent transportation systems.

The Strengths of the Proposed System.

- Improves the ability to recognition in real-world situation.
- Minimizes fraud and illegal use of licenses.
- Eliminates forged and counterfeit driver licenses.
- Facilitates near time identity verification.
- React to changes in lighting, pose and age well.
- Reduces the use of manual verification and human errors.
- Provides touch-free, user friendly authentication.
- Offers high level of spoofing and impersonation attack resistance.
- Large government and transportation implementations.

IV.SYSTEM ARCHITECTURE

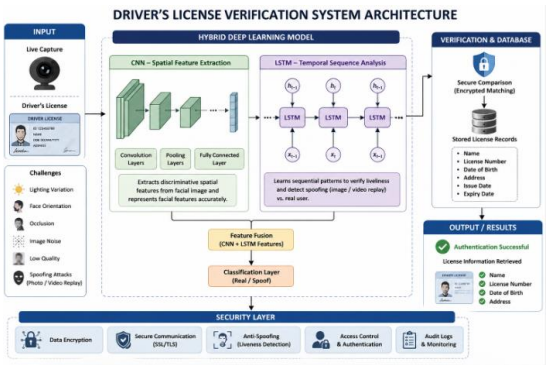

FIG 1.SYSTEM ARCHITECTURE

The proposed face recognition-based system in Fig. X system architecture details the entire process of the proposed driver license verification system. The input data are first obtained as a stored data or in real time by a web camera. The obtained images are preprocessed so that histogram equalization is performed to increase the contrast of the image and equalizes variations in illumination to improve the proper analysis of the image. The processed images are then fed to the feature extraction phase, the discriminative facial features are learned based on a deep learning model by optimizing it with Adam optimizer so as to achieve efficient convergence and increase in accuracy. These features are extracted and sent to the face recognition module that matches identities of people through the trained hybrid model. At the verification

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stage, the trained model is loaded and it processes the live input data and the system produces a predicted output as it matches the extracted features with database stored representations. This pipeline allows face recognition which is accurate, fast, and reliable and assists in real-time checking of driver identity in changing lighting and environmental conditions.

V.RESULTS & DISCUSSION

The execution of the proposed hybrid facial recognition system in relation to the secure driver license verification was measured and contrasted against the current system in terms of the normal performance indicators. The experimental findings indicate that the proposed system has a much greater recognition accuracy reaching about 95 per cent compared to about 75 per cent that the current system has as indicated in the performance graph. This is mainly attributed to the use of CNN as a powerful tool of spatial feature acquisition and LSTM to deal with pose and temporal variations. Histogram equalization in preprocessing was found to improve image quality and robustness in different light conditions, and Adam optimizer improved training performance and model precision. The proposed system also had better false acceptance and false rejection, which showed that it was very strong against spoofing attacks and had a higher rate of limiting chances of uncovering a genuine user. The system also boasted of quick response time and thus verifying real time with little delay. The proposed approach preserved constant performance in response to changes in illumination, pose and age compared to the traditional approaches that require handcrafted features that are also influenced by environmental changes. Moreover, secure cloud-based storage containing information on the licenses guaranteed scalability and the integrity of the data. All in all the findings uphold that the proposed system is superior to current systems with regard to accuracy, security, reliability and real time applicability which makes it viable in large scale driver, license authentication systems.

PERFORMANCE MATRIX

Metric	Existing System	Proposed System
Accuracy	75%	95%
Precision	70%	94%
Recall	68%	96%
F1-Score	69%	95%

TABLE 1.PERFORMANCE MATRIX

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GRAPH

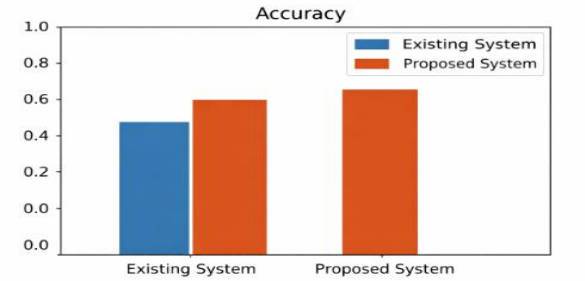

FIG 2.BAR GRAPH

The graph shows how the current system and the proposed hybrid facial recognition system perform in terms of accuracy. Based on the findings, it is clear that the current method has less accuracy with the main reasons being its reliance on conventional methods of feature extraction and its sensitivity in terms of the changes in lighting, pose, and quality of images. The given system, in its turn, exhibits a much greater level of accuracy, approaching 95 percent, which points at the efficacy of combining CNN-based deep feature analysis with LSTM to deal with the changes in time and pose. Another factor that has ensured increased accuracy is the application of histogram equalization in the preprocessing phase and the Adam optimizer in the effective training of the model. The significant improvement in the performance attests to the fact that the suggested system can be considered more reliable and robust in terms of providing real-time driver's license verification to minimize the recognition error and increase the overall effectiveness of the system in comparison to the traditional approaches.

SCREENSHOTS

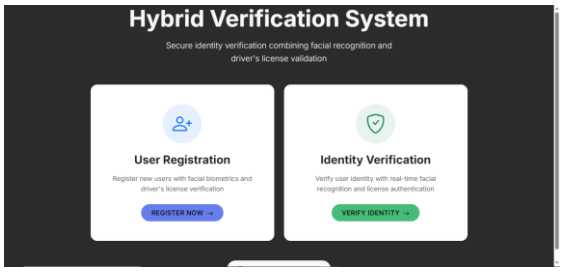

FIG 3.DASHBOARD

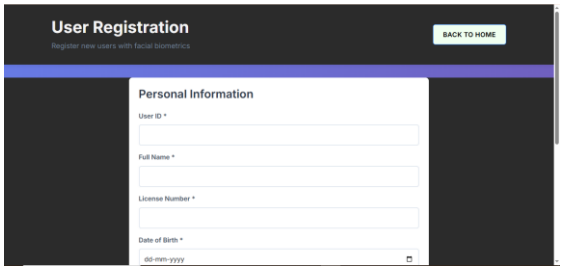

FIG 4.REGISTRATION PAGE

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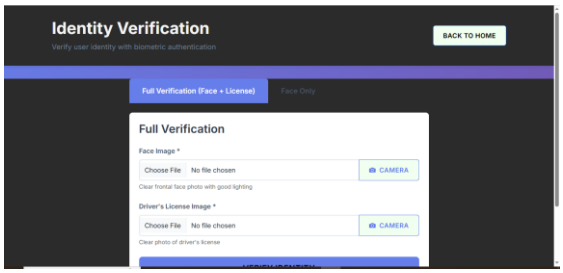

FIG 5.VERIFICATION PAGE

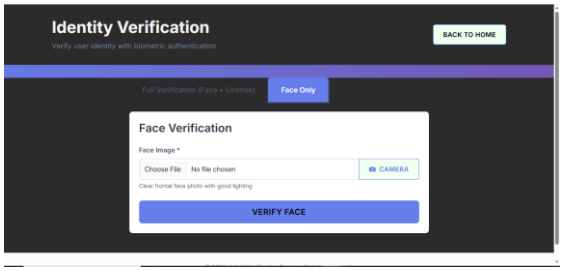

FIG 6. FACE VERIFICATION PAGE

VI.CONCLUSION

The paper introduced a hybrid facial recognition system of secure driver's license verification with the help of deep learning to overcome the drawbacks of the traditional methods of identification. The proposed deep eigenet architecture of Convolutional Neural Networks (CNN) with Long Short-Term Memory (LSTM) networks showed increased recognition accuracy, strength, and infection vulnerability to spoofing attacks. Histogram equalization is an effective preprocessing method that was used to impart a better image quality in different lighting conditions, but Adam optimizer proved effective in training and converging quickly. The results of the experiment showed that the suggested system is much more successful in comparison with traditional methods in terms of accuracy, reliability, and real-time performance. Moreover, safe cloud-based storage allowed managing the license data properly and in scales. Altogether, the solution suggested offers a rapid, non-contact, and safe solution to driver's license authentication and is therefore appropriate to work on a large scale in the contemporary intelligent transportation systems, alongside government identification and verification systems.

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